

Appl. No.: 10/525,903

Amdt. Dated August 20, 2007

Response to Office Action Mailed April 20, 2007

REMARKS:

Applicant appreciates the time and care the examiner has taken in examining the application. Applicant requests entry of the RCE and the amendments herein, and requests reconsideration of the final rejection of the claims, stating the following in support.

On the Amendments. No new matter is added in the amendments above. The claim amendments principally serve to clarify the following two features of this invention:

- 1) The optical waveguide is a Mach-Zehnder type optical waveguide; and
- 2) The structure needed to prevent stray light from entering the optical waveguide active part.

According to independent claim 28, the place of the stray light rejection means is specified to be between the optical waveguide active part and the substrate's side face near said optical waveguide active part, as described in the publication of this specification at page 5, Para. [0075] and in Fig. 2, numeral 13 to 17. And according to independent claim 33, the place of the low refractive index area is specified as surrounding area of the optical waveguide comprising the optical waveguide active part, as described in the published specification at page 5, Paras. [0084] to [0087], and in Fig. 5, numeral 40.

On the Beneficial Effects of the Invention as Claimed. The claimed invention yields the beneficial effect insofar as, because the escaping light from the optical waveguide is prevented from diffusing and the stray light is restricted from entering the optical waveguide, the photorefractive phenomenon caused by the stray light in the optical modulator can be restricted.

Thus, the claimed optical modulator improves characteristics relating to extinction ratio or optical loss of the signal light. In particular, the claimed optical modulator is able to restrict the photorefractive phenomenon, which causes degradation of the extinction ratio, etc., which appears most prominently when the optical modulator with the Mach-Zehnder type optical waveguide has more than 40 GHz of drive or more than 10 mW of optical input power. This is described in the published specification, in particular, at page 6, Paras. [0104] to [0105]. In addition, the amendments above emphasize the structural features leading to such improvement. Especially in the case of an optical modulator with a Mach-Zehnder type optical waveguide, the photorefractive phenomenon occurs chiefly in the optical waveguide active part; this is why the claimed invention can restrict said photorefractive phenomenon effectively.

On the Cited Prior Art. In U.S. Patent No. 5,267,920 (Kato et al.), a Mach-Zehnder waveguide is described, but stray light rejection is not described at all. In U.S. Patent No. 6,480,639 (Hashimoto et al.), only the problem caused by stray light from LD to PD is discussed. As a result, the combination of the features disclosed in Kato and Hashimoto cannot yield the features and functions set forth in the independent claims herein for restricting the photorefractive effect in the Mach-Zehnder type optical waveguide, needed to prevent stray light from entering the optical waveguide active part.

As specified in claim 33 herein, Fig. 5 shows that the light rejection means comprises a low refractive index area (reference numeral 40) that has a refractive index lower than that of the substrate and surrounds the optical waveguide; this stands as a salient characteristic which cannot be found in Hashimoto, especially as in the portions thereof cited by the Examiner (Hashimoto at Col. 3-4, Lines 45-67, 1-25, Col. 13-14, Lines 45-67, 1-25, Col. 15-16, Lines 20-67, 1-10, Col. 16, Lines 10-42) where there is no indication whatsoever of any low refractive index area mentioned. Hashimoto fails to disclose at all a low refractive index area that has a refractive index lower than that of the substrate and surrounding the optical waveguide.

What the Examiner had indicated specifically was "light blocking groove 20 formed on the surface" in Fig. 31A and Fig. 31B, "the wavelength selective filter 10" in Fig. 32A-C, and further in Embodiment No. 10, Fig. 13A and Fig. 13B, "an area 14 containing a large amount of metal" is provided. Then in Embodiment 13, Fig. 17, there are grooves 15 on the bottom surface, in Fig. 18 there is the making of fine irregularities on the surface. In Embodiment 14, Fig. 19, a resin layer 17 containing a light absorbent on the periphery of the optical module is established. Then, as a resin, a black epoxy resin is used. Also in embodiment 15, Fig. 20, a light blocking layer 19 comprising a metal is disclosed.

Moreover, in Embodiment 10 (Col. 13, Lines 65-66) it is disclosed that the metal used in such an area is Co, and from this area the stray lights are absorbed or scattered; that is, the metal in this area is merely dispersing or absorbing the light, and this is different from the attributes of the low refractive index areas set forth in the independent claims herein. In addition, as stated in Hashimoto (Col. 14, Lines 13-15), "[i]t is necessary to arrange and [sic] that the diffused metal does not reach the core part 2a of the optical waveguide and its periphery." Thus, the place where this area is being formed in Hashimoto's construction is clearly different from the present invention set forth in the independent claims, as shown in Fig. 5.

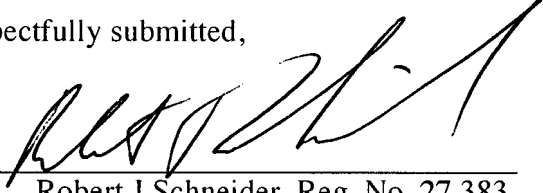
Thus, in Hashimoto there is no provision of a low refractive index area as provided in the claimed invention herein. Hashimoto fails altogether to disclose a low refractive index area that has a refractive index lower than that of the substrate and surrounds the optical waveguide.

Conclusion. It is respectfully submitted that the application is in condition for prompt allowance and that all of the objections, rejections and requirements raised in the Office action have been met. Early, favorable treatment of this application is requested.

The examiner is encouraged to telephone the undersigned with any questions or comments so that efforts may be made to resolve any remaining issues.

Extension Request and Deposit Account Charge Authorization. The Commissioner is hereby authorized to charge any additional fees, or credit any overpayment, associated with this communication, including additional fees for any additional extension of time under 37 CFR §1.136(a) for filling this communication, which extension is hereby requested, to our Deposit Account No. 50-0305 of Chapman and Cutler LLP.

Respectfully submitted,

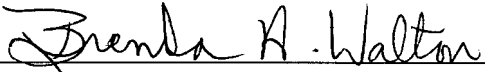
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CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8

Attorney Docket Number: 1716364
Date of Mailing: August 20, 2007

I hereby certify that the attached correspondence, namely: Amendment and Reply with Request for Continued Examination, check, return postcard and this certificate of mailing, is being deposited on the date listed above under 37 C.F.R. §1.8 with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Typed Name of Person Signing this Certificate: Brenda A. Walton

Date of Signature: August 20, 2007